Dear Client,

Thank you for purchasing our HTFA-109 CT PT Tester. Please read the manual in detail prior to first use, which will help you use the equipment skillfully.

Our aim is to improve and perfect the company's products continually, so there may be slight differences between your purchase equipment and its instruction manual. You can find the changes in the appendix. Sorry for the inconvenience. If you have further questions, welcome to contact with our service department.

The input/output terminals and the test column may bring voltage, when you plug/draw the test wire or power outlet, they will cause electric spark. PLEASE CAUTION RISK OF ELECTRICAL SHOCK!

◆ SERIOUS COMMITMENT

All products of our company carry one year limited warranty from the date of shipment. If any such product proves defective during this warranty period we will maintain it for free. Meanwhile we implement lifetime service. Except otherwise agreed by contract.

◆ SAFETY REQUIREMENTS

Please read the following safety precautions carefully to avoid body injury and prevent the product or other relevant subassembly to damage. In order to avoid possible danger, this product can only be used within the prescribed scope.

Only qualified technician can carry out maintenance or repair work.

--To avoid fire and personal injury:

Use Proper Power Cord

Only use the power wire supplied by the product or meet the specification of this produce.

Connect and Disconnect Correctly

When the test wire is connected to the live terminal, please do not connect or disconnect the test wire.

Grounding

The product is grounded through the power wire; besides, the ground pole of the shell must be grounded. To prevent electric shock, the grounding conductor must be connected to the ground.

Make sure the product has been grounded correctly before connecting with the input/output port.

Pay Attention to the Ratings of All Terminals

To prevent the fire hazard or electric shock, please be care of all ratings and labels/marks of this product. Before connecting, please read the instruction manual to acquire information about the ratings.

Do Not Operate without Covers

Do not operate this product when covers or panels removed.

Use Proper Fuse

Only use the fuse with type and rating specified for the product.

Avoid Touching Bare Circuit and Charged Metal

Do not touch the bare connection points and parts of energized equipment.

Do Not Operate with Suspicious Failures

If you encounter operating failure, do not continue. Please contact with our maintenance staff.

Do Not Operate in Wet/Damp Conditions.

Do Not Operate in Explosive Atmospheres.

Ensure Product Surfaces Clean and Dry.

一Security Terms

Warning: indicates that death or severe personal injury may result if proper precautions are not taken

Caution: indicates that property damage may result if proper precautions are not taken.

Contents

Preface

CT/PT TESTER is mainly used for field testing of P class CT and PT. The test items mainly include excitation characteristic, transformation ratio, polarity, Degauss, 5％ and 10％ error curves, secondary circuit check, withstand test of power frequency alternating current and secondary load. Adopt LCD, self-equipped minitype printer supporting field printing; supporting to use USB flash **disk** to dump data, with simple and convenient operation.

Precautions

➢ In order to ensure the safety of persons and equipment, please carefully read the operation manual before using the tester.

➢ The tester shall be reliably grounded when used, or persons or equipment may be damaged.

➢ Touching the connection terminals in the test is strictly forbidden.

➢ The tested CT must be in offline state, or the normal application may be affected or the test result may be incorrect.

➢ The tester shall be operated by professional technicians.

➢ Individually opening the equipment may lead to permanent damage.

Chapter I. Major Test Functions and Technical Parameters

1. Function Table

I. Current Transformer (CT）	II. Voltage Transformer (PT）
1. Magnetization Curve	1. Excitation Characteristic Test
2. Transformation Ratio Test	2. Transformation Ratio Test
3. Polarity	3. Polarity
4.5％ and 10％ error curve	4. Withstand Test of Power Frequency
5. Current Injecting	5. Degauss
6. Degauss	6. Calculation of Knee Point Value
7. Withstand Test of Power Frequency Alternating Current	
8. Automatic Calculation of Excitation Knee Point Value	

2. Technical Parameter Table

| Major Technical Parameters	
Operational Power Supply:	AC220V±20V, 50～60Hz
Equipment Power Supply Output Waveform:	Sine Wave
Single Machine Output Voltage of Excitation Characteristic:	0～2500V
Excitation Output Current Set:	0～20 A
Single Machine Output Current of Transformation Ratio Test	0～1000 A
CT ratio measurement range	5～25000A/5A（5000A/1A）
PT ratio measurement range	1～500KV
Error：	≤0.5%（0.2%*Reading+0.3%*Range）
Operating Temperature：	－10℃～+40℃
Relative Humidity：	＜90RH%
Altitude	≤1000m
Overall Dimension(Length×Width×Height):	450 *280 * 260（mm）
Weight:	≤30 Kg

Chapter II. Panel Illustration
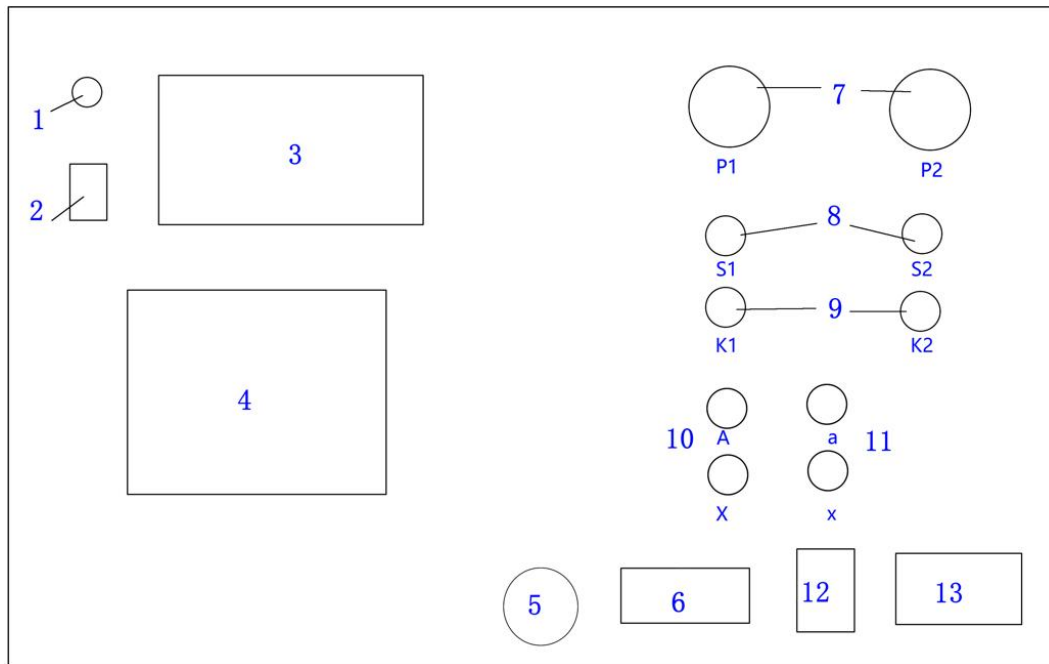
Figure 1

Note of Panel:

1—— Grounding

2——USB

3——Printer

4——Monitor

5—— Controller

6——Output (turned left for on and right for off.)

7——Current Output Terminal

8——Current Input Terminal(Connected to Secondary Side for CT Transformation Ratio Test)

9——Excitation Characteristic Power Output/The Port of Actual Secondary Load Test

10——Connected to Primary Side for PT Transformation Ratio Test

11——Connected to Secondary Side for PT Transformation Ratio Test

12——Power Switch

13—— Power Socket
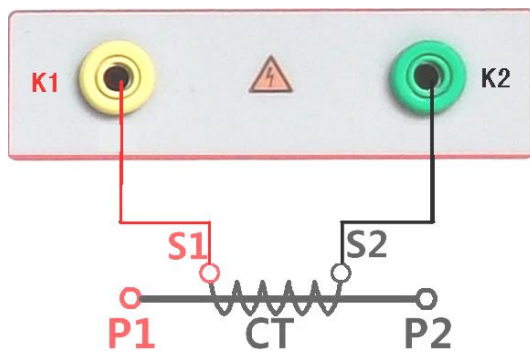
Figure 2(CT Excitation Connection Diagram)
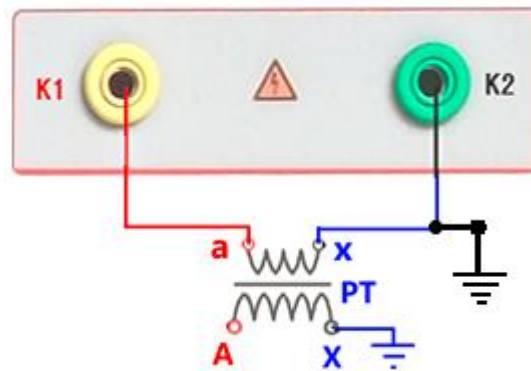
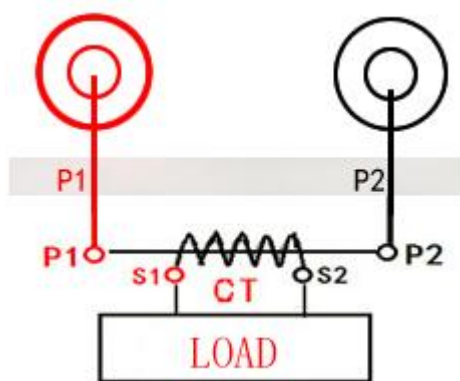Figure 3(PT Excitation Connection Diagram)

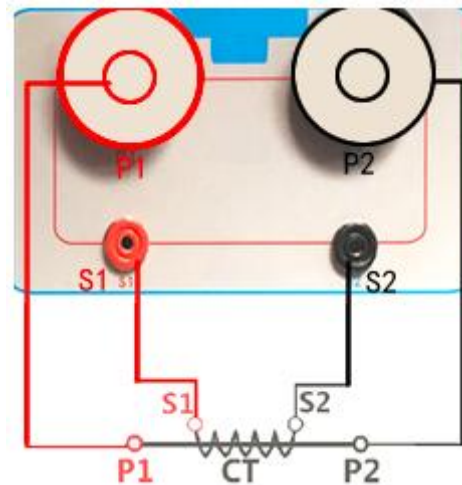Figure 4 (CT Current Output Connection Diagram)

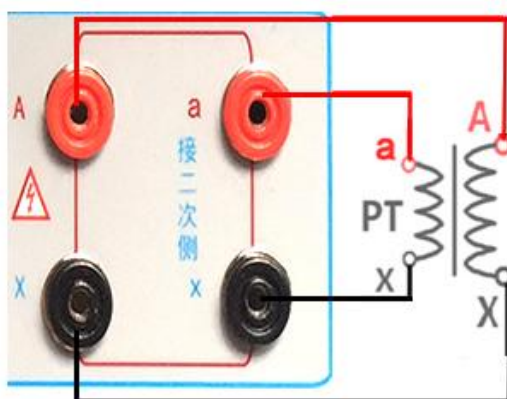Figure 5 (CT Connection Diagram for Transformation Ratio, Polarity)

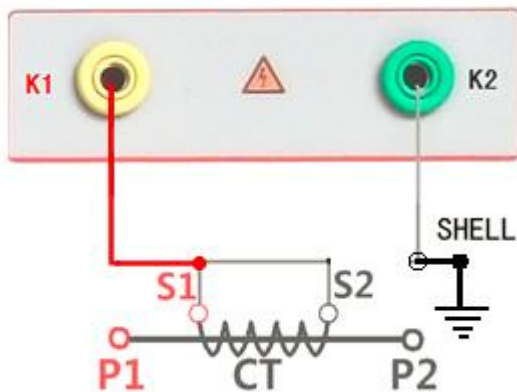Figure 6(PT Connection Diagram for Transformation Ratio, Polarity)

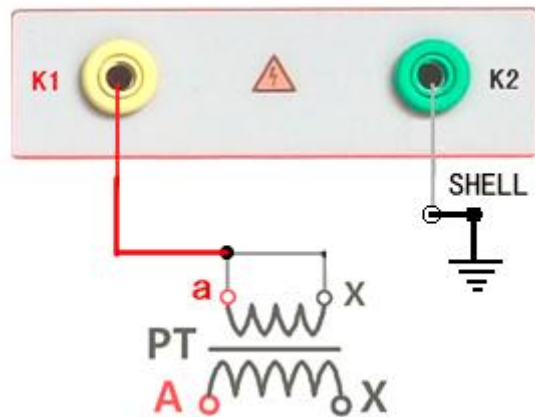Figure 7　(CT Connection Diagram for Withstand Test of Alternating Current)

Figure 8 (PT Connection Diagram for Withstand Test of Alternating Current)

Chapter III Operation Mode

1. Controller

The controller has three states: "Left Rotation", "Right Rotation" and "Pressing down". It is used to move the controller, input data and select the test item.

Figure 9 (CT Main Menu)

Figure 10　(PT Main Menu)

2. Main Menu

The main menu has seven items of "**Excitation**"、"**Ratio**"、"**AC Hipot**"、"**AC Current**"、"**Query**"and "**Degauss**," which can be selected and set with Controller.

Note: before test please set the number settings which will be saved as index information to facilitate the user to inquire.

NO.: (0000～9999)

3.Excitation.

Move the controller to **Excitation** For example to enter CT Test interface(Figure 11).

3.1. CT Excitation Characteristic Test: the connection mode is as shown in Figure 2.

Current**:**the setting range for test current is 0～20A (It is usually set to be 1A)

Voltage: The setting range for output voltage is 0～1000V

The function of calibration: mainly used to view the tester output voltage and current values

for the test project, Not to be used to test, The specific content   to see Appendix I.

3.1.1. Test:

After ensuring the correct wiring, turn on the output, press the "Test" key to start the test, After the completion of the test, the tester will automatically draw the figure of magnetization curve(Figure 12).

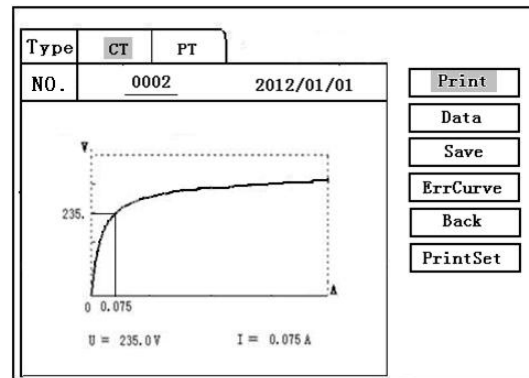Figure 11   Figure 12

3.1.2. Excitation Characteristic Function Items (as shown in Figure 12)

All operating function items on the interface are as following:

- Print: select "Print" item to print the excitation curve graphics and data.

- Data: Select "Data" item and the screen will display the list of excitation characteristic voltages and currents (shown in Figure 13).   Page up and down through turning the controller.

- Save: select "Save" item to save the current test results in the memory of the equipment and display "Saved".

- ErrCurve : as shown in the interface of Figure 12, select "ErrCurve" item and the screen will display the setting menu for corresponding error curve(see Figure 14).

  After the completion of the settings, the tester will automatically work out the error curve (as shown in Figure 15). The specific content   to see Appendix .

- Return: return to the previous interface.

- PrintSet： select "PrintSet" item and the screen will display the menu for the Data Set,you can select "Custom" to setting the current value to be printed ,or

- select "Default" (see Figure 16).

Figure 13

Figure 14

Figure 15

Figure 16

Setting of error curve

VA ： CT secondary side impedance value.

I-sn ： CT secondary side rating current (1A or 5A).

Kalf ： As for protection type CT (5P10 20VA)，"10" is Kalf

ALF ： As for protection type CT (5P10 20VA)，"10" is ALF

RCT ： CT secondary side resistance value.

5% ： Calculate the 5% error curve data and display the error curve.

10% ： Calculate the 10% error curve data and display the error curve.

Error Curve Function Items:

Print ： print the error curve graphics and data.

Data ： inquire error curve graphics and data.

Back ： return to the previous menu.

3.2. PT Excitation Characteristic Test (with connection mode shown in Figure 3)

Move the controller to **Excitation** ,to enter PT Test interface(Figure 17)

U-sn：　100V、100/√3V、100/3V、150V、220V.

Current **:** the setting range for output current is 0～20A (It is usually set to be 1A)

U-sn Multiple:MAX voltage of the pt excitation

Warning: the zero terminal of primary winding of the voltage transformer shall be grounded before the test, or high voltage will be output.

Please refer to the CT excitation characteristic test for the explanation of the operation method and test result.

Figure 17   Figure 18

4. Degauss Test

4.1. CT Degauss Test (The connection mode is as shown in Figure 2.)

Parameter Setting: as shown in Figure 21,

I-sn：1A or 5A.

Move the controller to"CT", Select Degauss to enter CT Degauss test interface (Figure 19).Select Test key to start the test. When the test is completed, the interface displays "success"，According to the actual situation, select "Test" or "Back".

4.2. PT Degauss Test (See Figure 3 for connection mode)

Parameter Setting: as shown in Figure 19,

U-sn：100V、100/√3V、100/3V、150V、220V.

Move the controller to"PT", Select Degauss to enter PT Degauss test interface (Figure 19).Select Test key to start the test. When the test is completed, the interface displays "success"，According to the actual situation, select "Test" or "Back".

Figure 19   Figure 20

5.   **AC Current:Current Output** (connection mode shown in Figure 5)

     Set Currrent: 0～1000A,

     Selection of output current (Figure 20)**:** maximum output current from P1 and P2 terminals of the tester. With the changing of the operating voltage, the actual output current will change with a deviation of 15%, which won't affect the application. After the completion of the setting, turn on the output, and select "Test" item. When the output current of the equipment reaches the setting value, it will be held for a period of time (the holding time is about 10MIN for the setting current less than 300A,between 300A and 500A the holding time is about 2MIN, the holding time is about 3S for the setting current greater than 500A.) During the test process, the controller will be displayed on the "Test" item and flashes constantly unless automatically escaped when the test is completed or the test is interrupted manually.

6.   **Ratio：Ratio and Polarity Test**

     6.1. CT Transformation Ratio and Polarity Test (connection mode shown in Figure 4)

     Move the controller to"CT", Select Ratio to enter CT transformation ratio test interface (Figure 17). Connect the CT primary side to P1 and P2, and the CT secondary side to S1 and S2,

     Parameter Setting: as shown in Figure 21,

I-p **: Setting range of primary output current:** 0～1000A.

I-s **:** 1A or 5A.

     After checking the correct wiring, Turn on the output. Move the controller to "Test" item to start the test. With increasing of AC output to the primary side of CT, the current values measured on the circuits on the primary and secondary sides will be displayed on the screen in real time. After the test, the transformation ratio and the polarity state will be worked out automatically.

     Polarity Discrimination Method: the homochromatic terminal of the tester is in-phase terminal, namely P1 connected to P1 of CT, and S1 connected to S1 of CT. The polarity is "-"subtractive polarity according to the test result.

During the test process, the controller will be displayed on the ""Test" item and flashes constantly unless escaped from the automatic test interface when the test is completed or the test is interrupted manually through pressing down controller. After the completion of the test, select "Print"、 "Save"or "Print".

Figure 21   Figure 22

6.2 PT Transformation Ratio and Polarity Test (connection mode shown in Figure 6)

Parameter Setting: as shown in Figure 22,

U-p : Setting range of output voltage: 0～1000V**.**

U-s： 100V、 100/√3V、 100/3V、 150V、 220V.

After checking the correct wiring, Turn on the output. Move the controller to start item of the transformation ratio and polarity test menu and press down the controller to start the test. The equipment will automatically give the transformation ratio result and polarity state(Figure 18).

Polarity Discrimination Method: the homochromatic terminal of the tester is in-phase terminal, namely A and a are in-phase terminals. The polarity is "-"subtractive polarity according to the test result.

During the test process, the controller will be displayed on the "Stop" item and flashes constantly unless escaped from the au tomatic test interface when the test is completed or the test is interrupted manually through pressing down controller. After the completion of the test, select "Print"、 "Save"or "Print".

7 .AC Hipot (Voltage Withstand Test of Alternating Current)

Move the controller to"CT"or"PT", Select **AC Hipot** to enter AC Hipot test interface (Figure 23), The users can set the AC output voltage to be 0～1000V according to their requirements.

Set Voltage ： Voltage output range (0～1000V)

8. 1: CT Test

The connection mode is as shown in Figure 10(CT), short circuit the secondary side S1 and

S2 and connect them to the tester voltage output terminal **K2**, while the other voltage output terminal of the tester **K1** is connected to the transformer shell.

move the controller to `Test` to increase the voltage and main it for 60S. If the flashover phenomenon occurs in the test, then CT secondary insulation against ground is deemed to be unqualified. If the leakage current is too much, the equipment will automatically return to zero for protection.

Figure 23

8. 2: PT Test

The connection mode is as shown in Figure11(PT), short circuit the secondary side 'a' and'x' and connect them to the tester voltage output terminal **K2**, while the other voltage output terminal of the tester **K1** is connected to the transformer shell.

move the controller to `Test` to increase the voltage and main it for 60S. If the flashover phenomenon occurs in the test, then CT secondary insulation against ground is deemed to be unqualified. If the leakage current is too much, the equipment will automatically return to zero for protection.

9．Index (Query)

9. 1. Record Inquiry

Move the controller to"CT"or"PT", Select Index to enter Index interface (Figure 24)**.** According to this interface, you can view the test results: "**Excitation**"、"**Load**"、"**Ratio**" 、 "**Error**"、"**Resistance**". Each piece of record will be displayed through "Number" and "Save Date". 8 pieces of data are displayed on each page, use controller to page up and down.

If the user wants to inquire certain group of file, he can move controller to the files of this group and then click it. The LCD screen will display the result.

9. 2 Dump Data

Under the Figure 25 interface, insert the USB flash disk to the USB interface of the tester

and press down "Copy To", then the tester start dumping the data to the USB flash disk. After that the screen will display "success".

   Warning: it is strictly forbidden to pull out the USB flash disk before the completion of the unloading, or the USB flash disk or the equipment will be damaged permanently.

   9. 3 Delete Files

   Press down "Delete"of "**Excitation**"、"**Load**" 、"**Ratio**"、 "**Error**"or "**Resistance**". then all saved results can be deleted in one time.

Figure 24	Figure 25

10. PC Software

   10.1 Operating ambient, WINDOWS XP and backward compatibility WINDOWS operating system.

   10.2Function description: open host computer software Integrated Test Equipment of Mutualinductor.

   a) choose the category of mutualinductor:"CT"or"PT".

   b) Click the button of open in figure 26,then the new interface(figure 27)will pop up. If you want to open transformation ratio and polarity data, click the button behind ratio/polarity and open transformation ratio and polarity data in USB disk.

   c) Click **Print** in the interface of voltage-current characteristic to print voltage-current characteristic curve and data. Click **Print** in the interface of deviation curve to print voltage-current characteristic curve & data and deviation curve & data simultaneously.

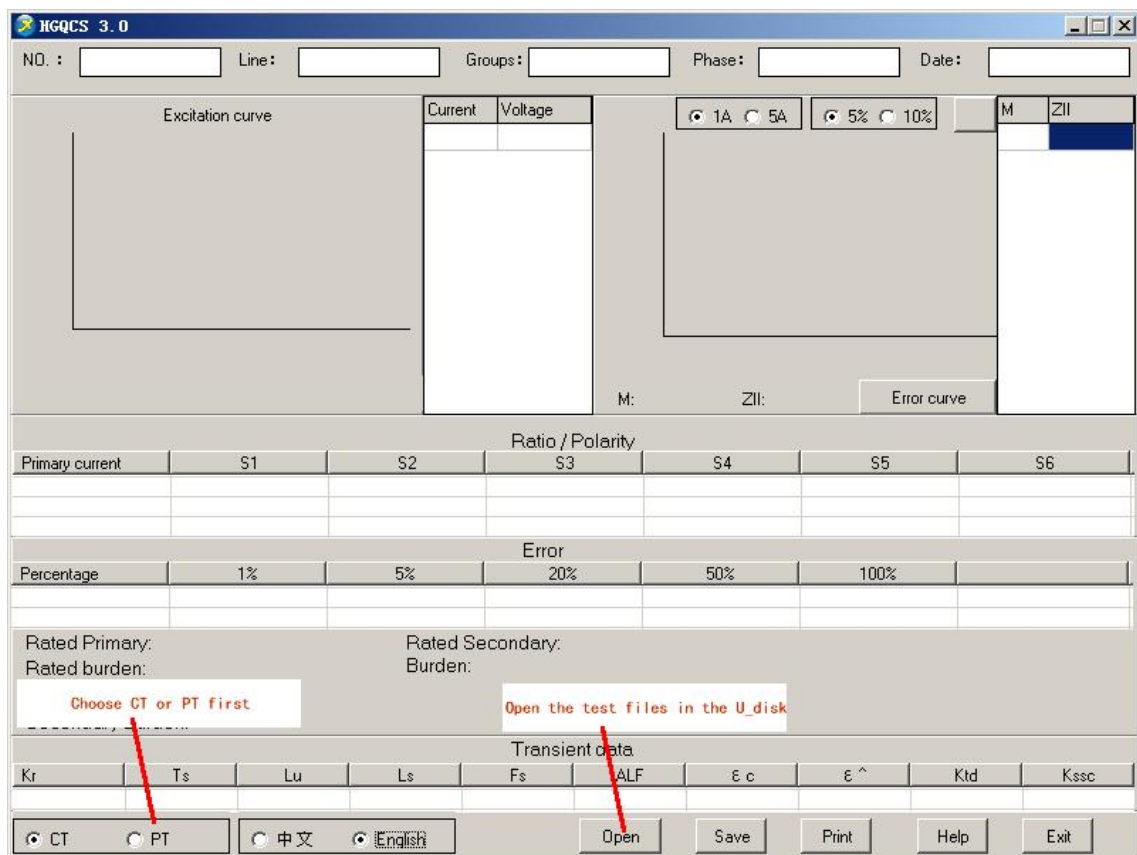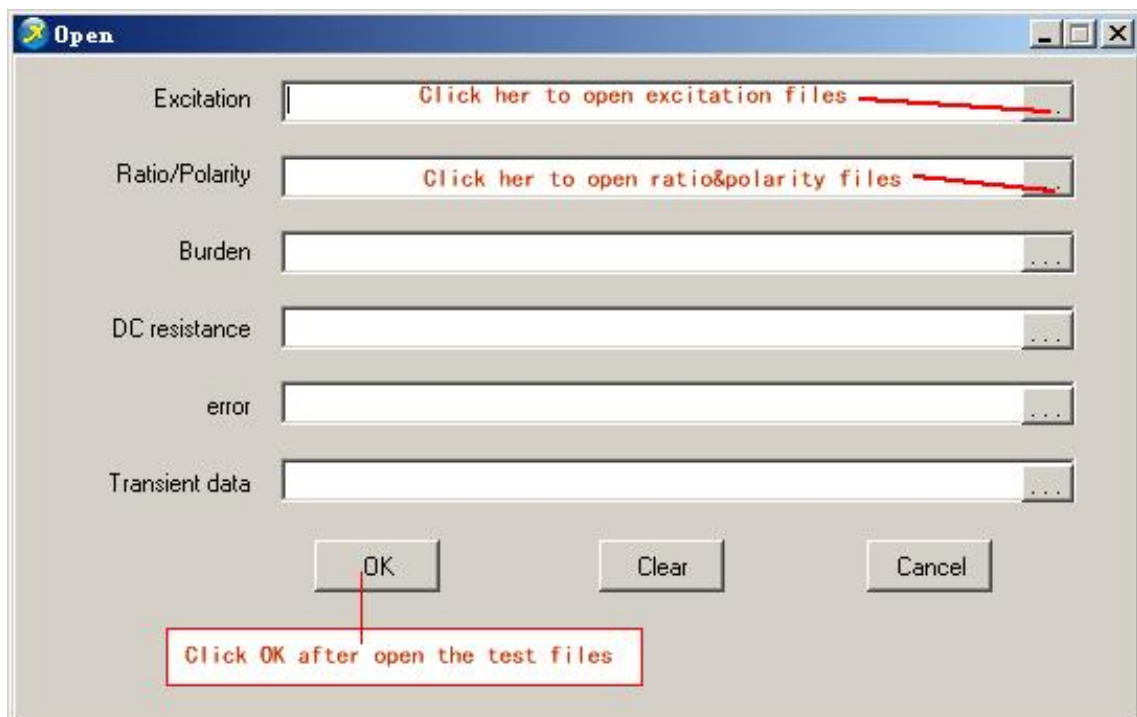   d) Click **Save** , then the data will be saved in WORD format.

Figure 26

Figure 27

ANNEX

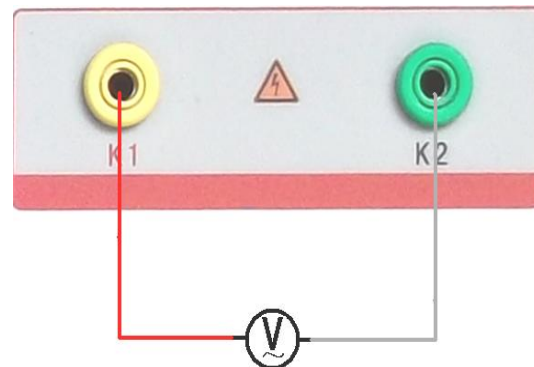**Annex 1.** The method of"Calibration" test (for example to CT)
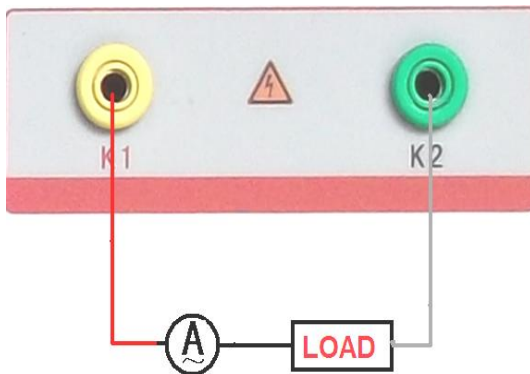

Figure 28

Figure 29

Figure 30

Move the controller to"CT"or"PT", Select **Verify** to enter Verify test interface (Figure 28), Set Voltage: 0.1A ～ 5A.　Set Current: 1V～1000V.

The connection mode of Voltage Calibration is as shown in Figure 29, After the completion of the setting, turn on the output, and select "Test" item. When the output voltage of the equipment reaches the setting value, it will be held for a period of time. After the completion of the test, click controllers,end of the test.

The connection mode of Current Calibration is as shown in Figure30, Voltage setting value is slightly higher than the Current setting value (A) * Load (Ω).After the completion of the setting, turn on the output, and select "Test" item. When the output voltage or current of the equipment reaches the setting value, it will be held for a period of time. After the completion of the test, click controllers,end of the test.

Annex 2. Replacement of paper. Cut off the power supply, press down the spring button on the printer, open the panel of the printer and take out its reel. Put the new paper roll in the printer showing the smooth surface, take out a small amount of paper and press down the panel. If the printing condition is normal, but there are no words or curve on the paper, the paper is installed inversely.

Error Curve Explanation

According to the data of 5% and 10% error curves between the current multiple（M）and permissible secondary load （ZII ） worked out based on excitation current and voltage on the secondary side of the transformer, we can decide whether the protection winding of the transformer is qualified;

The actual load measured based on the theory current multiple is greater than the theory load marked on the transformer nameplate, which indicates the transformer is qualified if it is in conformity with the data in the Figure 30:

The actual current multiple measured based on the theory load is greater than the theory current multiple marked on the transformer nameplate, which also indicates the transformer is qualified if it is in conformity with the data in the Figure 31,:

The secondary load of the protection type current transformer shall meet the requirement of 5％ error curve. Once the actual secondary load of the current transformer is less than the load permissible by the 5％ error curve, the measurement error of the qualified current transformer is within 5% based on the rating current multiple. If the secondary load is great, the core of the current transformer is easy to get saturated, and the permissible current multiple will be small. Therefore, 5％ error curve, namely n/ZL curve is the curve shown in Figure 18. As for protection type CT (5P10 20VA)shown in Figure 31, 5 is class of accuracy(error limit is 5 ％), P is transformer type(protection class), 10 is accurate limit value factor(10 times of rating current), 20VA is rating secondary load(capacity).　When the current multiple is 10.27(approaching 10), the permissible secondary load is 27.19Ω, greater than the rating load 20VA(20VA/1=20Ω) of this CT, which indicates the transformer is qualified. In addition, when the secondary load is 19.58Ω(approaching 20Ω), the permissible current multiple is 12.85, greater than the rating current multiple 10 of this CT, which indicates the transformer is qualified. In fact, either of the above factors can indicate the transformer is qualified.

If 10％ error doesn't conform to the requirements, the general measures taken are:

Increasing the section area of the secondary cable area (decreasing the secondary impedance)

Connecting the current transformers of the same type and transformation ratio in series(reducing the excitation current of the transformer)

Using the winding with high excitation characteristic (increasing the excitation impedance)

Increasing the transformation ratio of the current transformer (increasing the excitation impedance)

Type	CT	PT		Back
m		$Z_2(\Omega)$		
0.402		496.4		
0.828		332.1		
1.283		224.5		
1.695		172.2		
4.127		70.71		
6.835		41.19		
10.27		27.19		
12.85		19.58		
15.22		15.71		

Figure 31

Error curve calculation formula:

$M = (I*P) / N$ $ZII = (U - (I*Z2)) / (K*I)$

I　Current   U　Voltage

N=1　(1A Rating Current)   I Current

N=5　(5A Current)   Z2 CT Secondary Side Impedance

P=20 （5％Error Curve）   K=19 　（5％Error Curve. 1A 5A Rating Current）

P=10 （Error Curve ）   K=9 　（10％Error Curve. A 5A Rating Current）